II. REMARKS

Applicants gratefully acknowledge the Examiner's determination that claims 10-12, 15-19, 24 and 25 contain allowable subject matter (Office Action, dated February 12, 2010, at 7, lines 11-13).

The specification has been amended to incorporate subject matter illustrated by original Figure 8 and to further describe the embodiment described in ¶ [0034] of Applicants' specification as originally filed based on the subject matter shown in original Figure 8. A substitute specification in compliance with 37 C.F.R. § 1.125 is attached to incorporate the amendment mentioned above. The attached substitute specification contains no new matter.

Claims 15-17, 19 and 24 have been cancelled. Claims 1-3, 10, 12, 18, 20-23 and 25 have been amended. More specifically, the preamble of independent claims 1 and 21 has been amended to recite a "multi-step method for abrupt water hammerless opening of a fluid passage" as supported by ¶¶ [0007] and [0008] of Applicants' specification as originally filed. Independent claims 1 and 21 have also been amended to recite "wherein the valve body of the actuator operating type valve is moved from the state of full valve closing to the state of full valve opening in only two steps, or only three steps, or only four steps" as supported by ¶ [0057] of Applicants' specification as originally filed.

Claims 2, 3, 20, 22 and 23, which depend upon either claim 1 or 21, have been amended in accordance with the amendment to claims 1 and 21.

Independent claims 18 and 25 have been amended to recite that "the first 2-step actuator operating pressure includes a first step actuator operating pressure, an initial intermediate step operating pressure, and a second step actuator operating pressure, and a final step operating pressure," as supported by ¶¶ [0009], [0034], [0044], [0050], [0053]-

[0056] and [0066]-[0068] and original Figures 8 and 15 of Applicants' disclosure as originally filed. Independent claim 18 has been amended to recite

> "i. when vibration is generated at a time when the first step actuator operating pressure rises so the first step actuator operating pressure is equal to the initial intermediate step operating pressure, then the initial intermediate step operating pressure of the first 2-step operating pressure is adjusted so that the initial intermediate step operating pressure is lowered to form a corrected intermediate step operating pressure that is determined so as to decrease the vibration detecting signal Pr; and
>
> ii. when vibration is generated at a time when the second step actuator operating pressure rises so that the second step actuator operating pressure rises from the initial intermediate step operating pressure to the final step operating pressure, then the initial intermediate step operating pressure of the first 2-step operating pressure is adjusted so that the initial intermediate step operating pressure is raised to form the corrected intermediate step operating pressure that is determined so as to decrease the vibration detecting signal Pr,
>
> wherein a second intermediate step operating pressure is determined by repeating a plurality of preliminary adjustments of raising or lowering corrected intermediate step operating pressure so that the actuator operating type valve is made to open based on second control signal data that corresponds to a second 2-step operating pressure that includes the second intermediate step operating pressure, wherein the second control signal data is then inputted to the electro-pneumatic conversion device to control movement of the valve body without causing a water hammer because generation of vibration in the fluid passage is nearly zero, and the vibration detecting signal Pr is nearly zero,"

as supported by previous claim 18, and by ¶¶ [0009], [0034], [0044] and [0066]-[0068] and original Figures 8 and 15 of Applicants' disclosure as originally filed. Independent claim 25 has been amended to recite

> "i. when vibration is generated at a time when the first step actuator operating pressure drops so the first step actuator operating pressure is equal to the initial intermediate step operating pressure, then the initial intermediate step operating pressure of the first 2-step operating pressure is adjusted so that the initial intermediate step operating pressure is raised to form a corrected intermediate step operating pressure that is determined so as to decrease the vibration detecting signal Pr; and
>
> ii. when vibration is generated at a time when the second step actuator operating pressure drops so that the second step actuator operating pressure drops from the initial intermediate step operating pressure to the final step operating pressure, then the initial intermediate step operating pressure of the first 2-step operating pressure is adjusted so that the initial intermediate step operating pressure is lowered to form the corrected intermediate step operating pressure that is determined so as to decrease the vibration detecting signal Pr, wherein a

> second intermediate step operating pressure is determined by repeating a plurality of preliminary adjustments of raising or lowering corrected intermediate step operating pressure so that the actuator operating type valve is made to open based on second control signal data that corresponds to a second 2-step operating pressure that includes the second intermediate step operating pressure, wherein the second control signal data is then inputted to the electro-pneumatic conversion device to control movement of the valve body without causing a water hammer because generation of vibration in the fluid passage is nearly zero, and the vibration detecting signal Pr is nearly zero,"

as supported by previous claim 25, and by ¶¶ [0009], [0034], [0044] and [0066]-[0068] and original Figures 8 and 15 of Applicants' disclosure as originally filed.

Claims 10 and 12 depend upon claim 18 and have been amended in accordance with the changes made to claim 18.

The present amendment adds no new matter to the above-captioned application.

A. <u>The Invention</u>

The present invention pertains broadly to a method for water hammerless opening of a fluid passage, such as may be used to open a fluid passage during manufacture of semiconductors, chemicals, pharmaceuticals, and the like. Thus, in accordance with an embodiment of the present invention, a multi-step method for abrupt water hammerless opening of a fluid passage is provided that includes steps recited by independent claim 1. In accordance with another embodiment of the present invention, a multi-step method for water hammerless opening of a fluid passage is provided that includes steps recited by independent claim 18. In accordance with another embodiment of the present invention, a multi-step method for abrupt water hammerless opening of a fluid passage is provided that includes steps recited by independent claim 21. In accordance with still another embodiment of the present invention, a multi-step method for water hammerless opening of a fluid passage is

provided that includes steps recited by independent claim 25. Various other embodiments, in accordance with the present invention, are recited by the dependent claims.

An advantage provided by the various embodiments of the present invention is that a method for water hammerless opening of a fluid passage, such as may be used to abruptly open a fluid passage during manufacture of semiconductors, chemicals, pharmaceuticals, and the like, is provided wherein the method allows for the opening of a fluid passage both surely and abruptly without the generation of a water hammer.

B. <u>The Rejections</u>

Claims 10-12, 15-19, 24 and 25 stand rejected under 35 U.S.C. § 112, second paragraph, as allegedly indefinite.

Claims 1-3, 20, 21 and 23 stand rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over Burns (U.S. Patent 5,970,430, hereafter, the "Burns Patent") in view of Wheeler et al. (U.S. Patent 5,409,037, hereafter the "Wheeler Patent").

Applicants respectfully traverse the Examiner's rejections and request reconsideration of the above-captioned application for the following reasons.

C. <u>Applicants' Arguments</u>

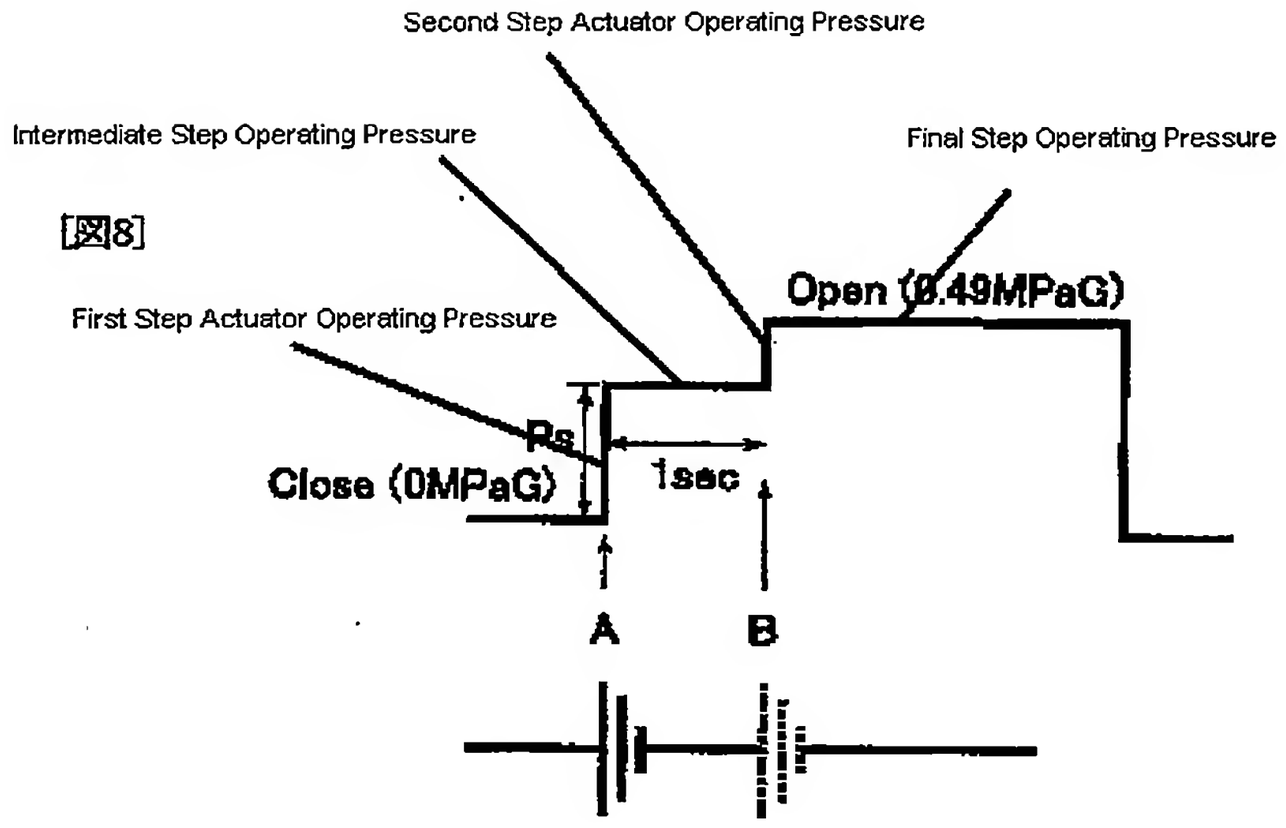
In view of the present amendment, claims 1-3, 10-12, 18, 20-23 and 25 are in compliance with 35 U.S.C. § 112.

i. <u>The Claims, as Amended, Comply with 35 U.S.C. § 112, Second Paragraph</u>

For a claim to comply with 35 U.S.C. § 112, second paragraph, it must (1) set forth what the Applicant regards as the invention and (2) it must do so with sufficient particularity and distinctness so as to be sufficiently "definite." Solomon v. Kimberly-Clark Corp., 55 U.S.P.Q.2d 1279, 1282 (Fed. Cir. 2000). During patent prosecution, definiteness of a claim may be analyzed by consideration of evidence beyond the patent specification, including the inventor's statements to the Patent and Trademark Office. Id. In view of the present amendment, claims 1-3, 10-12, 18, 20-23 and 25 are in compliance with 35 U.S.C. § 112, second paragraph, for the following reasons.

Independent claims 18 and 25 have been amended to recite that "the first 2-step actuator operating pressure includes a first step actuator operating pressure, an initial intermediate step operating pressure, and a second step actuator operating pressure, and a final step operating pressure" as shown in original Figure 8. An annotated version of original Figure 8 is provided below to explicitly indicate the various components of a "2-step actuator operating pressure" shown in original Figures 8 and 15.

As an aid to understanding the invention as claimed, Applicants previously provided an annotated version of Fig. 15 of the above-captioned application (See Amendment (E), filed on January 15, 2010). The Annotated Fig. 15 of Amendment (E) is reproduced below, and shows that the "first step actuator operating pressure" rises at time point Av to value Ps' and a "second step actuator operating pressure" rises at time point Bv to value Pa. As discussed above, the plateau at Ps' corresponds to the "intermediate step operating pressure" and the plateau that occurs when Pa is reached corresponds to the "final step operating pressure" of the 2-step actuator operating pressure. If vibration occurs at time point Av, then



the value of Ps' has to be reduced to avoid vibration (Applicants' specification, ¶ [0066]). On the other hand, if vibration occurs at time point Bv, then the value of Ps' has to be raised to avoid vibration (Applicants' specification, ¶ [0066]).

In view of Applicants' original disclosure, including Figs. 8 and 15 and ¶ [0066], a person of ordinary skill in the art would understand that the "first step actuator operating pressure" and the "second step actuator operating pressure" pertain to operating pressures at successively different times as the valve is made to move from a fully closed state to a fully opened state, and that the "intermediate step operating pressure" and the "final step operating pressure" correspond, respectively, to the plateaus that occur after the first step actuator operating pressure and the second step actuator operating pressure.

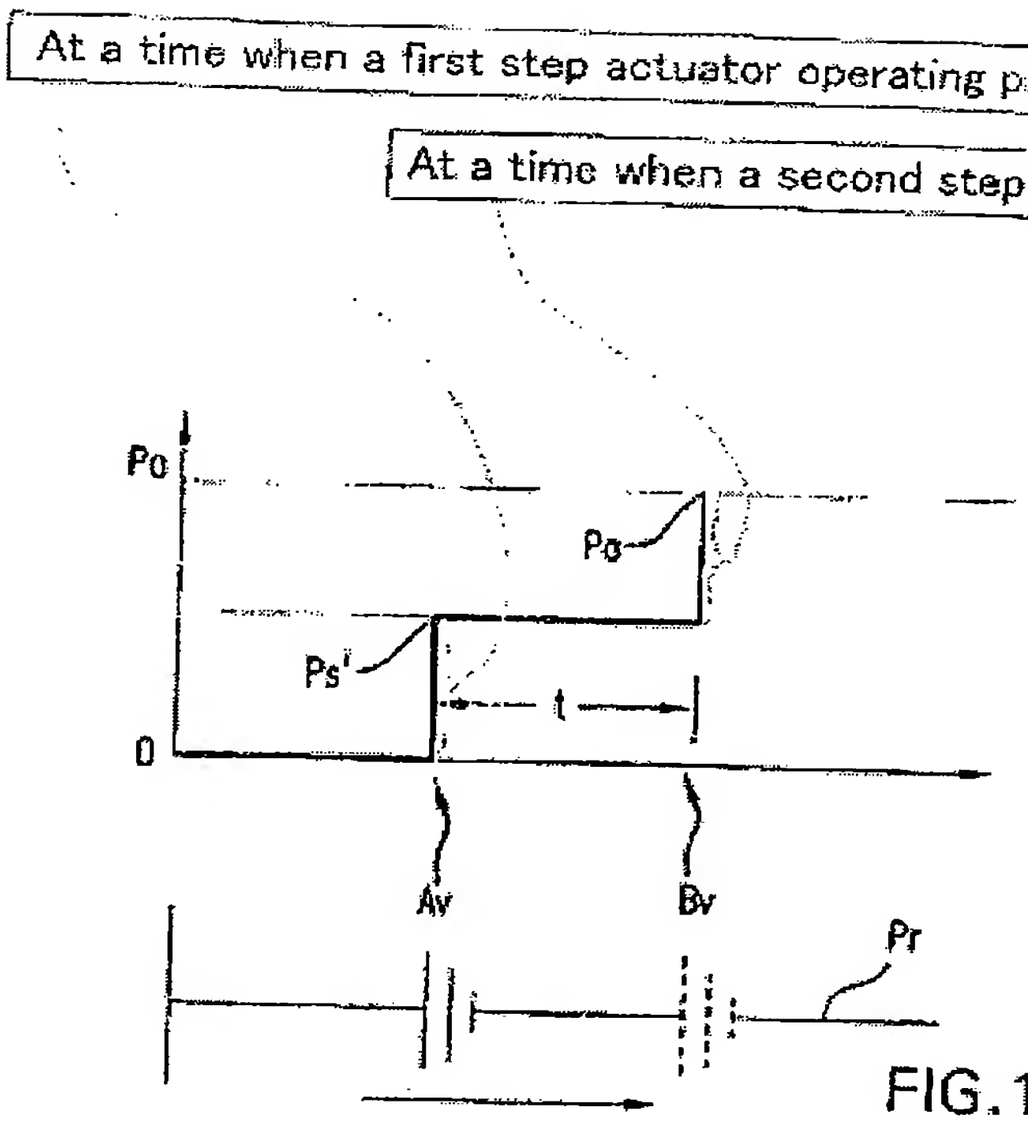


FIG. 15

In view of the present amendment, and the accompanying remarks, the Examiner should conclude that claims 1-3, 10-12, 18, 20-23 and 25 are in compliance with 35 U.S.C. § 112, second paragraph, and reconsider and withdraw the rejection under Section 112.

ii. <u>The Section 103 Rejection</u>

A <u>prima facie</u> case of obviousness requires a showing that the scope and content of the prior art teaches each and every element of the claimed invention, and that the prior art provides some teaching, suggestion or motivation, or other legitimate reason, for combining the references in the manner claimed. <u>KSR International Co. v. Teleflex Inc.</u>, 127 S.Ct. 1727, 1739-41 (2007); <u>In re Oetiker</u>, 24 U.S.P.Q.2d 1443 (Fed. Cir. 1992). In this case, the Examiner has failed to establish a <u>prima facie</u> case of obviousness against independent claims 1 and 21 because the Burns Patent and the Wheeler Patent, either alone or in combination,

does not teach, or suggest, each and every limitation recited by these claims. As conceded by the Examiner, neither the Burns Patent nor the Wheeler Patent teaches, or suggests, the subject matter of independent claims 18 and 25 (Office Action, dated February 12, 2010, at 7, lines 11-14).

iii. **The Burns Patent**

The Burns Patent discloses a "local device and process diagnostics in a process control network having distributed control functions" (See Abstract). In one embodiment disclosed by the Burns Patent, a public diagnostic causes a valve (109), such as shown in Figure 6, to move in a step-wise ramping manner according to Figure 10A (Burns Patent, col. 17, line 66, to col. 20, line 25). However, the Burns Patent discloses only a diagnostic "test operative cycle" for the valve (109). The Burns Patent does not teach, or even suggest, (i) "**the fluid passage is opened without causing a water hammer**" as recited by independent claims 1 and 21. As admitted by the Examiner (Office Action, dated February 12, 2010, at 5, lines 7-9), the Burns Patent also does not teach, or suggest (ii) "detecting a vibration detecting signal Pr from vibration of the pipe passage caused by a change of internal pressure of the pipe passage" as recited by claims 1 and 21.

However, these are not the only deficiencies in the disclosure of the Burns Patent. The Burns Patent also does not teach, or suggest, (iii) "providing a fluid passage…wherein the fluid passage has a nearly constant pressure inside the pipe passage" as recited by independent claims 1 and 21.

Furthermore, the Burns Patent does not teach, or suggest, (iv)

> "moving a valve body of the actuator operating type valve from a state of full closing in a direction of valve opening to a first degree of valve opening by increasing driving input to an actuator of the actuator operating type valve, wherein the driving input is increased to a first prescribed set value sufficient to

prevent a water hammer in the fluid passage,"

as recited by claim 1, and (v)

> "moving a valve body of the actuator operating type valve from a state of full valve closing in a direction of valve opening to a first degree of valve opening by decreasing driving input to an actuator of the actuator operating type valve, wherein the driving input is reduced to a first prescribed set value sufficient to prevent a water hammer in the fluid passage,"

as recited by claim 21. In other words, the Burns Patent does not teach, or suggest, a multi-step method for opening a valve so as not to generate the water hammer effect, wherein the "first prescribed set value is sufficient" to prevent the occurrence of the water hammer in the fluid passage.

The Burns Patent also does not teach, or suggest, (vi) "the valve body of the actuator operating type valve is moved from the state of full valve closing to the state of full valve opening in only two steps, or only three steps, or only four steps" as recited by claims 1 and 21. On the contrary, the Burns Patent discloses using at least five steps to open a valve (See, e.g., Burns Patent, col. 28, lines 9-23, and Figure 10A).

The Examiner argues that the limitation "in order to prevent a water hammer in the fluid passage" pertains to an "intended result" that, according to the Examiner, does not further limit the claimed method (Office Action, dated February 12, 2010, at 4, lines 15-18). The Examiner's argument is flawed and must be withdrawn because the invention is defined by the claims, Vas-Cath v. Mahurkar, 19 U.S.P.Q.2d 1111, 1118 (Fed. Cir. 1991). The Examiner has failed to demonstrate that there is a legally sound basis for excluding an "intended result" as patentable subject matter of this method claim in which the result serves to define the steps of the method. Specifically, claims 1 and 21 have been amended to recite "a first prescribed value sufficient to prevent a water hammer in the passage." Therefore, **the Examiner's argument is untenable and must be withdrawn**.

The Examiner additionally argues that that the method disclosed by the Burns Patent would "inherently" prevent the formation of a water hammer in the fluid passage (Office Action, dated February 12, 2010, at 4, lines 14-20). The Examiner's inherency argument is untenable on its face and must be withdrawn for the following reasons.

It is a well established proposition that a reference may inherently teach subject matter not explicitly disclosed by the reference when the reference's disclosure is sufficient to show that the implicit subject matter is the natural result flowing from the explicitly disclosed subject matter. Continental Can Co. USA Inc. v. Monsanto Co., 20 U.S.P.Q.2d 1746, 1749 (Fed. Cir. 1991). However, inherency cannot be established by mere probabilities or possibilities, and the mere fact that a certain thing may result from a given set of circumstances is insufficient. Id. The Federal Circuit has ruled that inherency is a question of fact. In re Napier, 34 U.S.P.Q.2d 1782, 1784 (Fed. Cir. 1995). In this case, the Examiner has failed to demonstrate that, based on the ten-step diagnostic method disclosed by the Burns Patent, the opening of the valve would naturally fail to generate a water hammer.

More specifically, the Burns Patent discloses a **diagnostic method** for operating conditions and control of opening and closing of networked valves (See, e.g., the digital field device of Figure 6 of the Burns Patent). **The Burns Patent is completely silent regarding the water hammer effect and how to take steps to avoid it when opening or closing a valve**. The technological idea of preventing generation of considerable vibration that occurs in fluid pressure inside a pipe when the pipe has a valve installed thereon, and the valve is operated to open from a fully closed state to a fully open state, is neither disclosed nor suggested by the Burns Patent. The fact that the valve opening/closing method disclosed by the Burns Patent may include ten steps does not mean that a water hammer is not produced.

The Burns Patent also does not teach, or suggest, a **multi-step** fluid passage opening method to avoid the water hammer effect, wherein in the first step the partially-opened position is held for a short time, Δt, before the valve is moved to the fully opened position in a second step. Furthermore, the Burns Patent does not teach, or even suggest, "the driving input is increased to a first prescribed set value sufficient to prevent a water hammer in the fluid passage" as recited by independent claim 1, and "the driving input is decreased to a first prescribed set value sufficient to prevent a water hammer in the fluid passage" as recited by independent claim 21.

According to the Burns Patent, a valve (109) may be opened in a plurality of steps, in particular five to ten steps, made at constant intervals as shown in Figure 10A of Burns (Burns Patent, col. 28, lines 9-16). The Burns Patent does not disclose a time period over which the valve is opened or closed. The water hammer, however, tends to occur during abrupt opening of a valve (See, e.g., Applicants' original specification, ¶ [0007]).

The idea of preventing a water hammer effect from occurring during abrupt opening of a valve is not disclosed in the Burns Patent. Thus, the Burns Patent does not teach, or even suggest, (vii) "a multi-step method for **abrupt water hammerless opening** of a fluid passage" as recited by claims 1 and 21. The Burns Patent also certainly does not teach, or even suggest, (viii) "wherein **the fluid passage is opened from the state of full valve closing to the state of full valve opening within 300 to 1000 msec without causing a water hammer**" as recited by claims 20 and 23.

In view of the above facts, the Examiner's inherency argument is flawed because the ten-step opening/closing diagnostic method disclosed by the Burns Patent most certainly could create a water hammer if performed abruptly, although it is not possible to predict whether a water hammer occurs under the conditions disclosed by the Burns Patent.

Therefore, it cannot be inherent to Burns' method that it prevents formation of a water hammer. In addition, a person of ordinary skill in the art would have absolutely no reason to believe, based on the disclosure of the Burns Patent, that a ten-step valve opening/closing diagnostic method would not generate a water hammer when performed over a time limit of 300 to 1000 msec. Even assuming, *arguendo*, that it might be possible for the ten-step diagnostic method disclosed by the Burns Patent to be performed slowly so as to avoid the water hammer (which is not a valid assumption), such a mere possibility is insufficient to establish a prima facie case of inherency. Continental Can Co. USA Inc. v. Monsanto Co., 20 U.S.P.Q.2d at 1749.

For all of the above reasons, the Examiner has failed to establish that the diagnostic method disclosed by the Burns Patent would necessarily prevent a water hammer because, regardless of whether the method is performed in five steps or in ten steps or more, the Burns Patent does not teach, or suggest, the time interval over which the diagnostic method is performed. Therefore, the Examiner's inherency argument regarding whether the method disclosed by the Burns Patent would prevent formation of the water hammer is based on pure speculation, and not on fact. Therefore, the Examiner's inherency argument is untenable and must be withdrawn.

a. The Water Hammer is not a "Term of Degree" As the Examiner Suggests

The Examiner contends that the "water hammer" phenomenon is a "term of degree" that would "occur to a greater or lesser extent if fluid flow in a pipeline is accelerated at any rate" (Office Action, dated April 30, 2009, at 8, lines 1-8). The Examiner's contention that a

"water hammer" is a term of degree, and would be present to some degree in all pipe systems is incorrect for the following reasons.

First, the "water hammer" phenomenon is **not subjective** (i.e., a "term of degree") as the Examiner suggests (See, e.g., Declaration under 37 C.F.R. § 1.132, executed by Kouji Nishino, a copy of which is filed herewith and is referred to as the "Nishino Declaration," ¶¶ 4-25). According to the "Waterhammer" webpage downloaded from www.omega.com (of record, hereafter the "Omega Document"), a waterhammer is (i) an impact load created by stopping and/or starting a liquid flow suddenly, (ii) occurs in the millisecond time frame and may damage pressure sensors, and (iii) waterhammers occur in almost all pressure systems and usually cannot be stopped without extensive time, energy and studies. Based on these facts, a person of ordinary skill in the art would understand that a waterhammer is an impact load caused by suddenly stopping or starting liquid flow, and that the impact load is substantial as it is measurable and causes damage to pressure sensors. In other words, the "waterhammer," as this term is used in the art, pertains to substantial shock waves produced during valve operation as evident from www.omega.com, of record.

The Examiner erroneously contends that the "Waterhammer" webpage is merely "puffing" and does not accurately define the waterhammer phenomenon (Office Action, dated September 15, 2009, at 11, lines 4-14). The Examiner's contention is not based on any facts, only the Examiner's unsubstantiated opinion. It is a well-settled proposition that rejections must be based on substantial evidence, and not on unsupported allegations. In re Zurko, 59 U.S.P.Q.2d 1693, 1697 (Fed. Cir. 2001).

To moot the issue, Applicants have provided additional evidence that the term "waterhammer" relates to an art recognized phenomenon that is an objective physical phenomenon, and is not subjective. Specifically, Applicants previously filed the following

documents: (i) Z. Michael Lahlou, WATER HAMMER, TECH BRIEF 2003, 4 pages, a copy of which is of record as "Exhibit A" and is also referred to hereafter as the "Lahlou Fact Sheet," (ii) Bob Formisano, *Fixing Water Hammer*, *at* http://homerepair.about.com/od/plumbingrepair/ss/pipe_noises_2.htm, downloaded August 14, 2009, 2 pages, a copy of which is of record as "Exhibit B" and is also hereafter referred to as the "Formisano Article," and (iii) *Water Hammer Calculation*, *at* http://lmnoeng.com/WaterHammer/WaterHammer.htm, downloaded August 14, 2009, 9 pages, a copy of which is of record as "Exhibit C" and is also hereafter referred to as the "LMNOENG Document."

The Lahlou Fact Sheet discloses that a "water hammer" is also referred to as "hydraulic shock," and pertains to the momentary increase in pressure that occurs in a water system when there is a sudden change of direction or velocity of the water (Lahlou Fact Sheet, first page, left col., lines 1-5). The Lahlou Fact Sheet discloses that a water hammer occurs when shock waves are set up within the water system that generate a "bang" because the pressure wave's velocity is equal to the speed of sound (Lahlou Fact Sheet, at 1, left col., lines 8-15). A person of ordinary skill in the art would immediately conclude that, according to the disclosure of the Lahlou Fact Sheet, the water hammer is a specific kind of transient pressure generated in a system when there is a sudden change of direction or velocity of water in the system, and that the water hammer is not a term of degree because it pertains to shock waves that generate a "bang," like a sonic boom, when the pressure wave's velocity is equal to the speed of sound (Nishino Declaration, ¶¶ 3-25). **Thus, a "water hammer" is a pressure wave that generates a banging sound, akin to a sonic boom in the pipe, due to the fact its velocity is at least equal to the speed of sound, which means the "water**

hammer" is an objective physical phenomenon and not a relative term of degree

(Nishino Declaration, ¶¶ 22-24).

The Lahlou Fact Sheet further discloses that weaker transient pressures generated by a slow motion mass oscillation of water caused by internal pressure fluctuations in a water system are called "surge" (Lahlou Fact Sheet, at 1, left col., lines 19-23). The Lahlou Fact Sheet discloses that both the "water hammer" and "surge" are referred to as "transient pressures" that may cause damage to pipes, fittings, and valves, and may cause leaks and shorten the life of the system (Lahlou Fact Sheet, at 1, left col., lines 23-29). Thus, according to the Lahlou Fact Sheet, while surge and the water hammer are both types of transient pressures, surge is the result of slow motion mass oscillation of water and the water hammer pertains to shock waves that generate a bang due to the waves' velocity reaching the speed of sound (Nishino Declaration, ¶¶ 9-12).

The Formisano Article discloses that the water hammer is a hydraulic shock observed in plumbing systems when a water valve or faucet is shut off quickly resulting in the loudest plumbing noise problem. The LMNOENG Document discloses calculations relating to the maximum and minimum piezometric pressures in each pipe in a pipeline, as well as the time and location where these pressures occur when valves close or open (See Introduction of the LMNOENG Document). Based on the Lahlou Fact Sheet, the Formisano Article, and the LMNOENG Document, a person of ordinary skill in the art would understand that the "water hammer," as this term is used in the art, pertains to substantial shock waves produced during valve operation as also evident from the Omega Document, and that the water hammer is a severe form of transient pressure that includes hydraulic shock waves having a velocity equal to, or greater than, sound (Nishino Declaration, ¶¶ 6-16 and 22-24).

While the Examiner contends that "Dictionary.com" provides a broader definition of the term "water hammer" (Office Action, dated February 12, 2010, at 9, lines 14-21; and Office Action, dated September 15, 2009, at 11, lines 14-19), Applicants previously objected to the fact that the Examiner failed to make the alleged reference of record (See, e.g., Amendment (G), at 32, lines 1-4). **The Examiner has still not made this alleged document of record**. However, Applicants believe that they have independently obtained a copy of the alleged document, which is filed herewith as "Exhibit D."

Exhibit D includes three alleged definitions of the "water hammer" and not just the one the Examiner has arbitrarily adopted. The definition relied upon by the Examiner, namely, that a "water hammer" is "the concussion and accompanying noise that result when a volume of water moving in a pipe suddenly stops," is imprecise, overly broad, and not in accordance with how the term "water hammer" is generally used in the art by those of ordinary skill as evident from the disclosures of the Omega Document, the Lahlou Article, the Formisano Article, and the LMNOENG Document (Nishino Declaration, ¶¶ 17-21). This is because the term "water hammer" refers to transient pressures that have a velocity that is equal to, or greater than, the speed of sound in the liquid in the pipe so that the water hammer is associated with a banging noise, which is akin to a sonic boom occurring inside the pipes (Nishino Declaration, ¶ 22). The definition of "water hammer" relied upon by the Examiner is broad enough to read on any transient pressures that make any kind of noise, which is not in accordance with the art recognized meaning of the term "water hammer" (Nishino Declaration, ¶ 23).

In addition, the definition from Exhibit D employed by the Examiner is not in accordance with how the term "water hammer" is defined and used by the specification and claims of the above-captioned application. According to ¶ [0007] of the above-captioned

application, the "water hammer" pertains to transient pressures that cause the breakdown of devices or instruments connected to the passage (Nishino Declaration, ¶ 23). The definition of "water hammer" employed by the Examiner, however, is so broad that it includes transient pressures that are not a water hammer, and that are not even surge (Nishino Declaration, ¶¶ 17-19).

Exhibit D includes a definition for "water hammer" that includes a "banging noise heard in a water pipe following an abrupt alteration of the flow with resultant pressure surges." This second definition of "water hammer" is more consistent with how the term is generally used in the art (Nishino Declaration, ¶ 20). Consequently, the Examiner has not given the definitions included in Exhibit D a fair reading as a whole (Nishino Declaration, ¶ 21). Applicants remind the Examiner that the Examiner has a duty to give a fair reading to what a reference discloses as a whole. In re Gordon, 221 U.S.P.Q. 1125, 1127 (Fed. Cir. 1984). In this case, the Examiner has not given a fair reading to Exhibit D because the Examiner should be applying the narrower definition of "water hammer" that is in accordance with how that term is generally understood in the art.

It is a well settled proposition that while dictionaries and other extrinsic sources of information may be used to demonstrate the ordinary meaning of a term of art, the use of extrinsic sources may not be used to contradict the meaning otherwise apparent from the intrinsic record (e.g., Applicants' specification). Helmsderfer v. Bobrick Washroom Equipment, Inc., 527 F.3d 1379, 1382 (Fed. Cir. 2008). In this case, Applicants' original specification, ¶ [0002], states as follows:

> "It has been widely known that when a passage through which a liquid such as water or the like passes is abruptly closed, there occurs so-called water hammer with which the pressure rises inside the passage on the upstream side of the closed point with vibrations, thus various problems such as the breakdown of devices or instruments connected to the passage being caused by said water hammer."

Thus, Applicants' original specification identifies the "water hammer" as a pressure rise causing vibrations that lead to the breakdown of devices and instruments connected to the passage. Thus, Applicants' definition of water hammer may include both water hammer and surge-type transient pressures, both of which cause the breakdown of devices or instruments connected to the fluid passage, such as pipes, fittings and valves (Nishino Declaration, ¶¶ 9-11 and 25). Applicants' specification is not contradicted by the disclosures of the Lahlou Article, the Formisano Article, the LMNOENG Document, and the Omega Document. However, the definition for water hammer alleged by the Examiner from Exhibit D, wherein noise will occur to a lesser or greater degree if fluid is stopped, is overly broad and is not consistent with the disclosures of the Lahlou Article, the Formisano Article, the LMNOENG Document, and the Omega Document, which require a "banging noise" associated with the water hammer, and not just any noise. As discussed above, Exhibit D includes a second definition of "water hammer" that is in accordance how the term is used in the art.

Furthermore, and, more importantly, the definition for "water hammer" taken by the Examiner from Exhibit D is not consistent with Applicants' specification, which identifies the "water hammer" as an effect that leads to the breakdown of devices and instruments exposed to the water hammer's vibrations. Figures 4(b) and 6 of Applicants' original disclosure illustrate transient pressures that are nearly zero and that do not fall within the scope of the "water hammer" as claimed. Therefore, **not all vibrations in a pipe may be construed to be a "water hammer" as the Examiner suggests** because Applicants' original disclosure clearly describes transient pressures that are nearly zero in magnitude and that are explicitly not construed to be a water hammer.

As shown in Figures 4(a), 4(b), 6, 7(a), 7(b), and 7(c), and as described on page 22, line 20, to page 23, line 2, of Applicants' original disclosure, there is a step pressure Ps according to the present invention that minimizes vibration pressure and prevents the water hammer. However, as shown in Figures 4(b) and 6, for example, nearly zero vibrations may persist, which Applicants' original specification clearly identifies as transient pressures that do not constitute a water hammer (Applicants' original specification, ¶¶ [0057], [0060] and [0061]).

A person of ordinary skill in the art would not consider any measurable or unmeasurable perturbations in the system, such as cannot harm pressure sensors for example, as a "water hammer." In other words, as evident from Applicants' Figure 7(c), there is no evidence of any substantial shock waves generated during opening of the valve under these conditions. Furthermore, whether any insignificant, mostly undetectable pressure waves are produced during valve closure conditions of Figure 7(c) is irrelevant because such weak, difficult to detect pressure waves cannot be construed as a water hammer according to Applicants' original disclosure and would not be construed as a "water hammer" by a person of ordinary skill in the art because they are not capable of causing damage to the valve and/or pressure sensors over time. The broad definition of "water hammer" proposed by the Examiner, wherein any pressure fluctuation associated with any noise whatsoever is construed to be a water hammer, is not consistent with Applicants' specification and is not consistent with the disclosures of the Lahlou Article, the Formisano Article, the LMNOENG Document, and the Omega Document.

It is a well-settled proposition that, during examination, the USPTO may give the broadest reasonable interpretation to claim terms that are consistent with an applicant's specification. In re Hyatt, 54 U.S.P.Q.2d 1664, 1666 (Fed. Cir. 2000). For all of the reasons

discussed above, an interpretation of "water hammer" that is so broad that it reads on any transient pressure that makes a sound regardless of whether the transient pressure may cause breakdown of devices or instruments connected to the passage is not consistent with the Applicants' specification, or with how the term "water hammer" would be understood by persons of ordinary skill in the art.

For all of the above reasons, the Examiner's reliance on an inappropriate, overly broad definition of "water hammer" cannot be maintained when construing the claims of the above-captioned application.

b. The Examiner's Inherency Argument is Untenable and Must be Withdrawn

The Burns Patent discloses an apparatus and method for diagnosing a valve. The Burns Patent is completely silent regarding whether a water hammer is created within its pressure system. The "Waterhammer" webpage from www.omega.com (the Omega Document), however, discloses that almost all pressure systems create a water hammer. As evident from the Omega Document and from Figures 7(a), 7(b) and 7(c) of Applicants' disclosure, **special conditions are required to avoid the water hammer, and these special conditions generally require extensive study to determine**. Therefore, a person of ordinary skill in the art would have absolutely no basis for concluding that the device and method disclosed by the Burns Patent inherently avoids the water hammer.

On the contrary, inherent subject matter may be implied from a reference only where the disclosure is sufficient to show that the implicit subject matter is the natural result flowing from the explicitly disclosed subject matter. Continental Can Co. USA Inc. v. Monsanto Co., 20 U.S.P.Q.2d 1746, 1749 (Fed. Cir. 1991). Inherency, however, cannot be established by

mere probabilities or possibilities, and the mere fact that a certain thing may result from a given set of circumstances is insufficient. Id. Thus, in view of the fact that the Burns Patent is silent regarding the waterhammer effect, and does not disclose a time frame with respect to valve opening or closure, and in view of the fact that most pressure systems create a water hammer when abruptly closed or opened (see, e.g., the Omega Document, of record), it is more likely than not that the pressure system disclosed by the Burns Patent **inherently produces a water hammer**. The Examiner has failed to rebut the facts that lead to this conclusion.

The Examiner erroneously contends that the step-wise valve closure disclosed by Burns would employ the same mechanism as Applicants' invention and, therefore, achieve the same water hammer avoiding results (Office Action, dated September 15, 2009, at 11, line 22, to 12, line 11). The Examiner blatantly ignores the above facts and Applicants' Figure 5(a), which shows a multi-step closure that still produces a water hammer, and Figure 5(c), which shows a multi-step closure that does not produce a water hammer (i.e., vibrations are nearly zero), (Applicants' specification, ¶¶ [0040] to [0042]). Thus, the facts show that while a multi-step procedure for opening a valve may avoid the water hammer, the avoidance of the water hammer using a multi-step procedure involves careful study to determine precisely how much the valve must be opened in each step in order to avoid the water hammer, and over what time period the opening procedure must be performed to avoid the water hammer. **The Examiner has failed to rebut these additional facts**, which obliterate the Examiner's argument that a multi-step valve opening procedure inherently prevents the water hammer.

For all of the above reasons, the Examiner has failed to establish that the Burns Patent inherently discloses opening the fluid passage "**without causing a water hammer**" as recited by claims 1 and 21.

vi. The Wheeler Patent

The Wheeler Patent discloses an "automatic device for the detection and shutoff of excess water flow in pipes" such as shown in Figure 1a, and which is reproduced below.

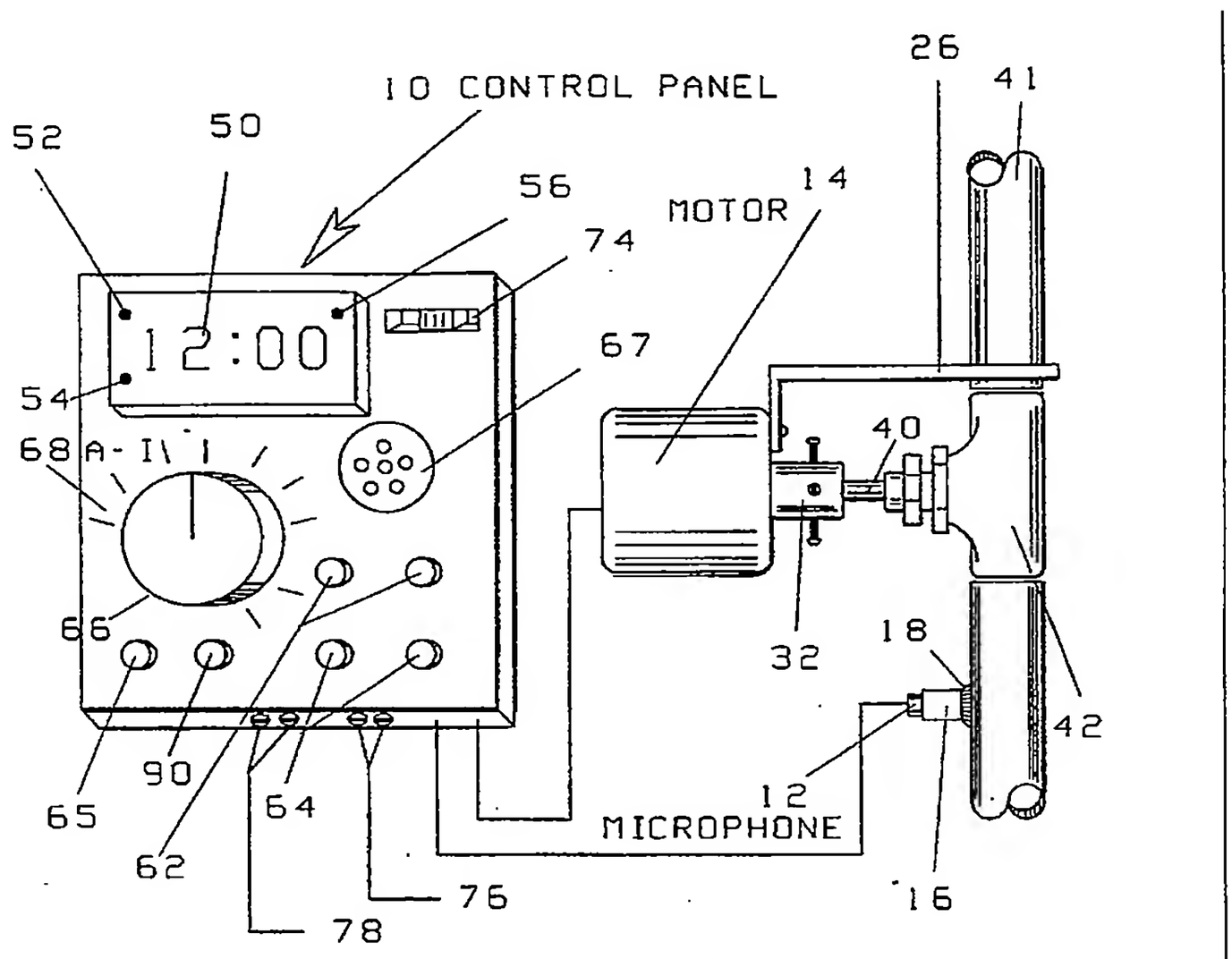


Figure 1a

According to the Wheeler Patent, a detachable automatic programmable water shutoff device, for stopping the flow of excess water in plumbing pipes of a plumbing pipe system, comprises a detachable acoustic flow sensor (12) that is placed externally on existing plumbing pipe, a detachable valve actuator which consists of a high torque motor (14) attached to existing plumbing pipe valve stem (32), and a microprocessor based control

circuit (See Figure 2a), which (a) monitors the state of the flow sensor (12), (b) provides an operator control interface to the device, (c) determines excess water flow conditions, and (d) provides an output signal to the high torque motor (14), which shuts off the water for an excess water flow condition (See Abstract of the Wheeler Patent). Thus, as would be instantly appreciated by a person of ordinary skill in the art, the device disclosed by the Wheeler Patent operates to shut off water in a pipe when excessive water flow is detected. The Wheeler Patent does not teach, or even suggest, (i) "**the fluid passage is opened without causing a water hammer**," and (ii) "providing a fluid passage…wherein the fluid passage has a nearly constant pressure inside the pipe passage," as recited by independent claims 1 and 21.

On the contrary, the Wheeler Patent discloses a device and method for shutting off a valve when excess water flow is detected. The Wheeler Patent does not teach, or suggest, opening a valve in a manner so that a water hammer is avoided.

The Wheeler Patent also does not teach, or suggest, (iii)

> "moving a valve body of the actuator operating type valve from a state of full closing in a direction of valve opening to a first degree of valve opening by increasing driving input to an actuator of the actuator operating type valve, wherein the driving input is increased to a first prescribed set value sufficient to prevent a water hammer in the fluid passage,"

as recited by claim 1, and (iv)

> "moving a valve body of the actuator operating type valve from a state of full valve closing in a direction of valve opening to a first degree of valve opening by decreasing driving input to an actuator of the actuator operating type valve, wherein the driving input is reduced to a first prescribed set value sufficient to prevent a water hammer in the fluid passage,"

as recited by claim 21. In other words, the Wheeler Patent does not teach, or suggest, a multi-step method for opening a valve so as not to generate the water hammer effect, wherein

the "first prescribed set value" is one that prevents the occurrence of the water hammer in the fluid passage.

The Wheeler Patent also does not teach, or suggest, (vi) "the valve body of the actuator operating type valve is moved from the state of full valve closing to the state of full valve opening in only two steps, or only three steps, or only four steps" as recited by claims 1 and 21.

v. Summary of the Disclosures

The combined teachings of the Burns Patent and the Wheeler Patent still fails to teach, or even suggest, (i) "**the fluid passage is opened without causing a water hammer**," (ii) "providing a fluid passage…wherein the fluid passage has a nearly constant pressure inside the pipe passage," and (iii) "the valve body of the actuator operating type valve is moved from the state of full valve closing to the state of full valve opening in only two steps, or only three steps, or only four steps" as recited by independent claims 1 and 21. The combination of the Burns Patent and the Wheeler Patent also does not teach, or suggest, (iv)

> "moving a valve body of the actuator operating type valve from a state of full closing in a direction of valve opening to a first degree of valve opening by increasing driving input to an actuator of the actuator operating type valve, wherein the driving input is increased to a first prescribed set value sufficient to prevent a water hammer in the fluid passage,"

as recited by claim 1, and (v)

> "moving a valve body of the actuator operating type valve from a state of full valve closing in a direction of valve opening to a first degree of valve opening by decreasing driving input to an actuator of the actuator operating type valve, wherein the driving input is reduced to a first prescribed set value sufficient to prevent a water hammer in the fluid passage,"

as recited by claim 21.

As established above, the Burns Patent does not explicitly or inherently teach, or suggest, that "the fluid passage is opened without causing a water hammer" as recited by claims 1 and 21. The Wheeler Patent, too, is silent regarding opening a fluid passage in a manner that prevents the formation of a water hammer. Therefore, the combined teachings of the Burns Patent and the Wheeler Patent cannot explicitly or inherently teach, or suggest, opening a fluid passage in a manner so as to not cause a water hammer. See, e.g., the Federal Circuit's ruling in In re Newell, 13 U.S.P.Q.2d 1248, 1250 (Fed. Cir. 1989), which prohibits establishing a prima facie case of obvious based on a retrospective view of inherency. According to the Federal Circuit, the doctrine of inherency cannot be applied to a hypothetical construct resulting from the combination of disclosures to establish a prima facie case of obviousness because speculation regarding potential properties of such a hypothetical construct is not permissible. Id.

For all of the above reasons, the combination of the Burns Patent and the Wheeler Patent cannot render obvious the subject matter of independent claims 1 and 21.

vi. The Examiner has Failed to Demonstrate a Reasonable Expectation of Success of Avoiding the Water Hammer with a Multi-Step Procedure Even if the Disclosures of the Burns Patent and the Wheeler Patent are Combined

A proper rejection under Section 103 requires showing (1) that a person of ordinary skill in the art would have had a legitimate reason to attempt to make the composition or device, or to carry out the claimed process, and (2) that the person of ordinary skill in the art would have had a reasonable expectation of success in doing so. PharmaStem Therapeutics, Inc. v. ViaCell, Inc., 491 F.3d 1342, 1360 (Fed. Cir. 2007). In this case, the Examiner has

failed to show that a person of ordinary skill in the art would have had a legitimate reason to modify the methods disclosed by the Burns Patent so as to perform a multi-step opening operation as claimed, and the Examiner has failed to show that even if such a modification of the Burns Patent was made, that the result would be a method wherein "the fluid passage is opened without causing a water hammer" as recited by claims 1 and 21.

As described in Applicants' specification, at 22, lines 3-9, a two-step opening operation does not necessarily result in avoidance of the water hammer effect because the two-step opening operation generally needs to be carefully adjusted in order to avoid generating a water hammer. This fact can also be seen by comparing Figures 5(a) and 5(c) of the above-captioned application because while the two-step opening procedure shown in Figure 5(c) avoids the water hammer, the two-step opening operation shown in Figure 5(a) does not. Therefore, according to Applicants' original disclosure, there is no guarantee that a randomly selected multi-step opening procedure will prevent the water hammer.

Because neither the Burns Patent nor the Wheeler Patent teaches, or suggests, how to open a valve without generating a water hammer, a person of ordinary skill in the art would have no reasonable expectation of success of arriving at Applicants' claimed invention, which does not generate a water hammer when the valve is opened in multiple steps. As would be appreciated by a person of ordinary skill in the art, Applicants' invention achieves opening of a passage without formation of a water hammer due to the judicious selection of step parameters (i.e., driving inputs), which are determined by experimentation. Therefore, even if the methods disclosed by Burns Patent, or by the combination of the Burns Patent and the Wheeler Patent, were modified to open the valve (109) in two-steps, three-steps or four-steps, the Examiner has failed to demonstrate that a person of ordinary skill in the art would have had a reasonable expectation of success of obtaining a "multi-step method for abrupt water hammerless opening

of a fluid passage" wherein "the fluid passage is opened without causing a water hammer" as recited by claims 1 and 21.

For all of the above reasons, the Examiner has failed to establish a prima facie case of obviousness against claims 1-3, 10-12 and 15-25 of the above-captioned application.

vii. Applicants' Evidence of Non-obviousness

When an applicant adduces specific data demonstrating substantially improved results, and states that the results are unexpected, then in the absence of evidence to the contrary, applicant has established unexpected results sufficient to prove the invention is nonobvious. In re Soni, 34 U.S.P.Q.2d 1684, 1687-88 (Fed. Cir. 1995). The invention need only be compared to the closest prior art, In re Johnson, 223 U.S.P.Q. 1260, 1264 (Fed. Cir. 1984), however, it is acceptable to compare the invention to subject matter that is closer to the invention than the closest prior art. Ex parte Humber, 217 U.S.P.Q. 265, 266 (Bd. Pat. App. & Inter. 1981).

In this case, Figures 5(a) and 5(c) of Applicants' original disclosure demonstrate the non-obviousness of the present invention. Figure 5(a) shows a two-step opening procedure that generates a water hammer. Figure 5(c) shows a two-step opening procedure that does not generate a water hammer. The difference in the embodiments shown in Figures 5(a) and 5(c) is that the driving input for the valve according to the embodiment of 5(c) has been adjusted, in magnitude and in time during the opening procedure, so that the water hammer effect is prevented. This result is substantially different for the result shown in Figure 5(a) and the result was unexpected.

For all of the above reasons, the Examiner's alleged case of obviousness against claims 1 and 21 of the above-captioned application is untenable and should be withdrawn.

III. CONCLUSION

Claims 1-3, 10-12, 18, 20-23 and 25 are in compliance with 35 U.S.C. § 112. No art-based rejection stands against claims 10-12, 18 and 25, which are therefore allowable for the reasons of record. Furthermore, the Examiner has failed to establish a prima facie case of obviousness under 35 U.S.C. § 103(a) against claims 1-3 and 21-23 because the combined disclosures of the Burns Patent and the Wheeler Patent fails to teach, or even suggest, each and every limitation recited by independent claims 1 and 21, and because the Examiner has failed to demonstrate that a person of ordinary skill in the art would have enjoyed a reasonable expectation of success of obtaining Applicants' claimed invention even if the combination asserted by the Examiner was made.

For all of the above reasons, claims 1-3, 10-12, 18, 20-23 and 25 are in condition for allowance, and a prompt notice of allowance is earnestly solicited.

The below-signed attorney for Applicants welcomes any questions.

Respectfully submitted,

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